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The Atlantis Garrison: A Comprehensive, Cost Effective Cargo and Port Security Strategy

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by Dr. Michael J. Hillyard, President, Rockwell University

"When you are faced with spending priorities on cargo security, focus on systems that reach beyond our borders, not within them. Focusing your spending programs on systems within the boundaries of our ports would be the equivalent of putting radiation detectors outside of this building. When the nuke gets that close, it is too late."

—Randall Larsen, CEO, Homeland Security Associates[1]

Introduction

This essay proposes a solution to U.S. cargo and port inspection and security problems through the construction and use of offshore ports to screen, inspect, and transfer cargo for delivery inside the United States. Such a system would use offshore platform technologies, called pneumatically stabilized platforms, to provide large acreage ports that would be more cost effective to maintain and more efficient to screen inbound ships and inspect and transfer cargo than alternatives—such as overhauling the current ports systems at home and abroad. Offshore ports are proposed as a critical link into a port and cargo security defense-in-depth system involving a cargo security information system, offshore ports, and the current ports system. Also proposed are public/private administrative models to regulate and manage the offshore ports.

The Cargo and Port Security Problem

The United States has a major cargo inspection problem of size, location, and time. Regarding size: 95 percent of all cargo entering the country passes through one of the nation's 351 ports; 95 percent of that cargo goes unchecked;[2] and of the 8,000 foreign commercial vessels that make 60,000 annual port calls, the vast majority gain unabated access to U.S. soil.[3] The size of the problem increases dramatically over time: port cargo volume is expected to double by 2025.[4] The United States cannot securely handle the sheer volume of port calls, something not lost on enemies who have been unable to strike the U.S. homeland for almost four years now.

The location problem is twofold, and worse. First, the instant foreign vessels reach a port of call, they are potential weapons of mass destruction (WMD) shell casings for harbor-detonated nuclear weapons. There is currently no effective process to confirm that a ship is not a weapon. Second, even if all incoming ships and cargo were inspected, it would not matter because a WMD has already accomplished its mission. Currently, high risk cargo is either inspected at the port or, incredibly, driven to an inspection location one to fifteen miles inland. A potential weapon of mass destruction is thus unobstructed in its delivery inside the country, and even when identified as dangerous cargo, loses none of its destructive potential.

Time is the ultimate trade-off in the cargo and port security problem. Not acting quickly to fix the problem will result in devastating consequences. Maritime transportation experts warn that the current global ports system *can and will* be exploited by terrorists with ships or containers filled with explosive and/or nuclear devices—it is just a matter of when and where such attacks will occur.[5] The consequences of just one such attack are estimated to run as high as $1 trillion in economic costs and are immeasurable in human costs.[6]

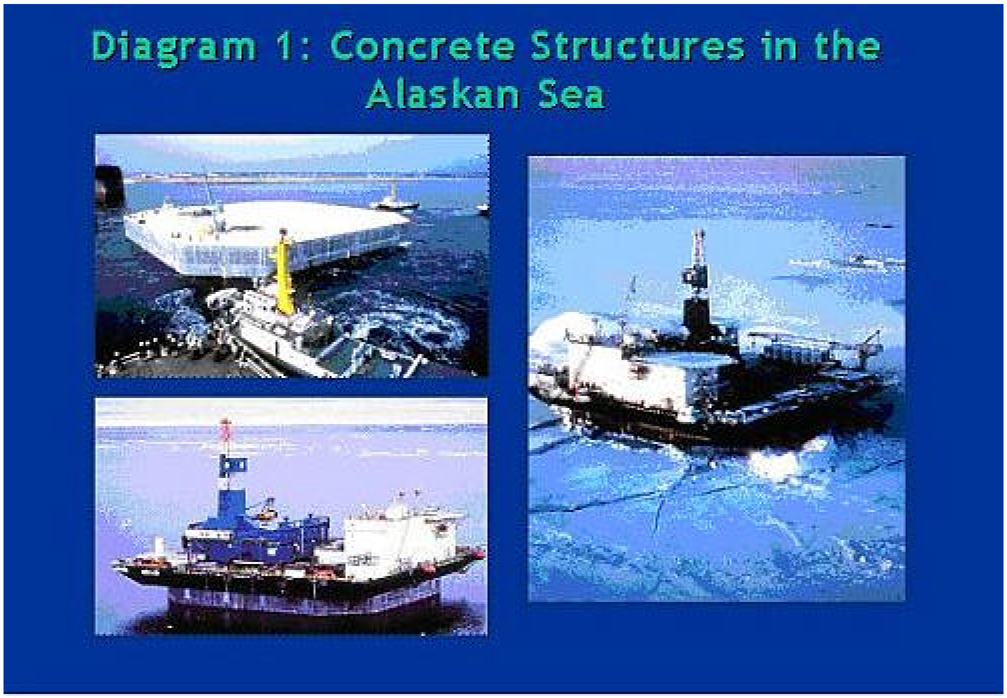
Asa Hutchinson, the Department of Homeland Security's former undersecretary for border and transportation security, summarizes the other side of the timeliness dilemma: "The waterways are a concern; we're not there in a perfect security environment...(but) do you shut down our economic system…I think we learned that you can't do that."[7] The economic consequences of shutting down the Port of Long Beach/Los Angeles (which receives over 40% of the nation's total container imports) or the Mississippi Waterway and Houston Ship Channel (which receive one-half of the nation's tanker imports) for an extended period of time due to security fears or inefficient port inspection procedures could trigger a recession.[8] And, because the inspection process is fundamentally flawed, and the country is so vulnerable to seaborne attack, even just the threat of a bomb becomes a credible nightmare. Time is also a major consideration when trying to convince several hundred state- and locally- subsidized port authorities to comply with increasingly onerous federal security standards.

The size, location, and time issues embedded in the cargo and port security problem far exceed current proposals and resources, and they will not be resolved by tinkering with the existing ports system. A new system must be designed that is proactive and not reactive; applies the age-old military principle of a "defense-in-depth"; allows for the speed and cost of commerce; and comprehensively addresses global shipping from the product, to the container, to the ship, to the port, to the destination, all the way through the final delivery of every product in the container.

New Port Technology

Dating back to 1955, with Shell Oil Company's development of techniques and equipment to float small-scale offshore oil drilling operations in all-weather conditions, semi-submersible hull technologies have invaluably advanced oil, gas, scientific discovery, and mineral extraction industries, among others.[9] While these technologies have worked exceedingly well in supporting some of the world's most sophisticated sea systems, they are constructed as a single module, with the largest platforms scaling to 90,000 square feet, or approximately two acres. To gain precious acreage for more extensive sea operations, the platforms can be built vertically, rising several decks above the ocean's surface. Many potential sea capabilities, however, require vastly greater horizontal breadth. Attempts have been made for years to link small platforms together into larger ones, but the pressure induced by sea waves and deck loading has resulted in structural failures.

Recent contributions from public and private sector oceanic scientists, architects, and engineers have evolved the offshore technologies to reduce the stresses on the platform, allowing modules to be joined as floating structures that enable order of magnitude increases in scale—and associated load bearing capability—to the hundreds of acres, attenuate waves, and withstand the severest ocean conditions posed by even hurricanes, typhoons, or tsunamis. These stress reducing systems, referred to as pneumatic stabilized platforms (PSPs), decouple the platform from the waves. PSPs allow for the construction of permanent ocean real estate (see Diagram 1—a reinforced concrete structure of a similar design using the PSP design principle) that can support the scale of a midsize municipal floating airport, a port with the load bearing equivalent of the nation's median cargo volume facility, Port Vancouver (Washington), or a military installation the size of Pearl Harbor Naval Shipyard.[10]

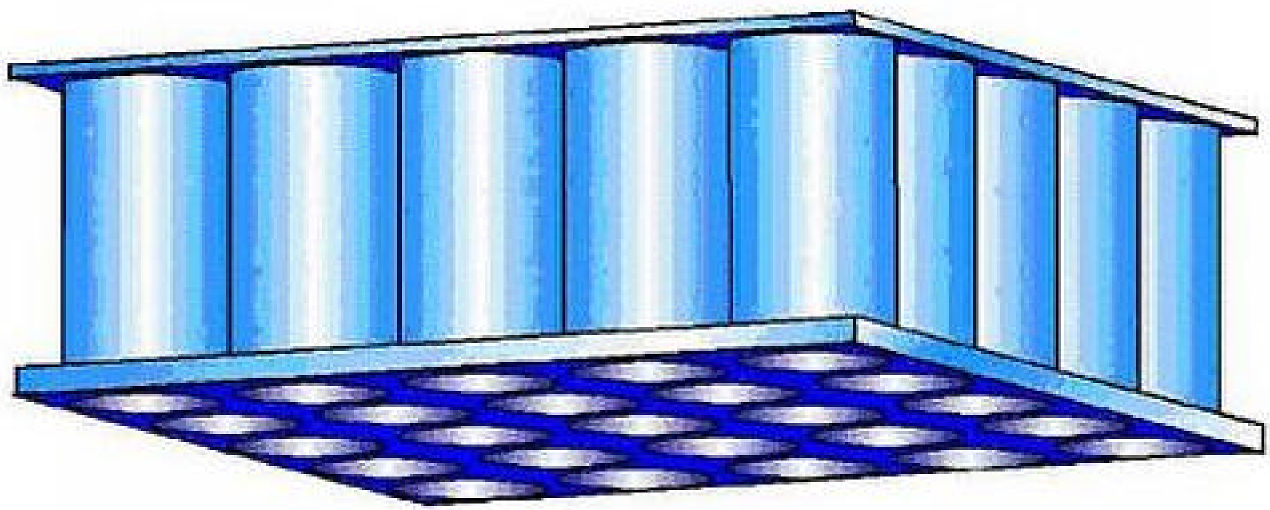


As with many of the world's greatest advances, the evolution to the new platform technologies is fairly easy to understand with the benefit of hindsight. Its scientific underpinnings are grounded in freshman-level college physics.[11] Grand platform scale is achieved through *displacement*, wherein concrete cylinder modules, which remain open at the bottom and closed at the top, capture an air pocket used for buoyancy.[12] Platform stability is maintained through a manifold and duct system that connects the individual cylinders, allows air to transfer between cylinders, and enables the platform to self-adjust as waves pass under it.[13] When a wave approaches the platform, the water column in cylinders closest to the wave rise. On normal floating structures, the rising wave creates lift (or heave) to the structure.

The rise in one area and drop (or trough) in another creates the destructive stress. In the PSP, when the rising water column begins to compress the air pocket, the manifold and duct system allows the air to migrate to a cylinder or module where the column is falling. This reduction of wave energy, or decoupling the platform from the waves, gives the platform stability and reduces the stress that would otherwise be induced. The reduction of waves as they pass beneath the platform (i.e., wave attenuation) also creates a "calm sea" environment so that ships may be docked.[14] Figure 1 illustrates the closed top, open bottom, and manifold features of a PCP component. Figure 2 demonstrates how singular components connect into a modular system.

Figure 1: PCP Singular Component (artist's rendition, courtesy of Float, Inc.)

Figure 2: PCP Modular System (artist's rendition, courtesy of Float, Inc.)



As far back as the mid-1930's, civil engineers developed the first concrete cylinder-based, air-buoyant platform for construction of the mid-span suspension bridge caisson between Oakland and San Francisco (that is still in use today after the 1989 Oakland earthquake and millions of vehicles traversing the bridge).[15] Since then, there have been several more applications, to include a specially designed oil production platform for Global Marine in the Alaskan Sea[16] and a Defense Advanced Research Project Agency/Office of Naval Research-sponsored PSP model to test advanced wave attenuation and load distribution capabilities. New initiatives to apply the technology and their associated strategic implications include:

- floating military targets to alleviate diplomatic pressures such as those incurred in Vieques, Puerto Rico in 1993;[17]
- floating, movable military installations (a small-scale example of which is sketched in Diagram 2) to alleviate pressures of basing and overflight access as experienced in the Iraq War;
- floating regional Asian energy centers to serve some of the world's most densely populated cities;
- a multi-purpose entertainment, casino, and restaurant complex adjacent to real estate-challenged Monaco;
- a wave energy facility off of the coast of England;
- and several options for floating airport runways and even entire airports, as is the case at the San Diego International Airport.

A Floating Ports System

While government and commercial applications demonstrate the diversity of ocean real estate these new offshore technologies enable, the most significant application could be realized in a system of offshore ports to protect and defend the United States. Envisioning an ocean equivalent of the nation's highway toll system, a series of cargo security screening ports could be strategically located as close as 2-3 miles or as far as 12-15 miles offshore,[18] transecting the major U.S.-bound global sea lanes.

These offshore ports would build on the government's Container Security Initiative (CSI)—an initiative that places customs officials at foreign ports to prescreen and target high risk cargo—by providing the opportunity to scan and inspect a high percentage of all suspect cargo while it is at sea. The offshore ports would also prevent a ship-based dirty bomb attack from affecting the U.S. population by offloading, scanning, and reloading cargo on secured lighters or barges; provide the option to prevent any foreign vessel from reaching U.S. shores (while still enabling foreign vessel cargo offloads at the offshore port); and provide a more efficient intermodal system in which platform-supported air, sea, rail, and truck cargo transfers could occur at a single location.

An offshore port can be configured in a variety of ways, two examples of which are detailed in Diagram 3. A conceptual depiction of a smaller transfer port is provided in Diagram 4. Both examples in Diagram 3 are configured for ships to dock on the reverse side of incoming waves in the PSP-enabled calm sea environment:

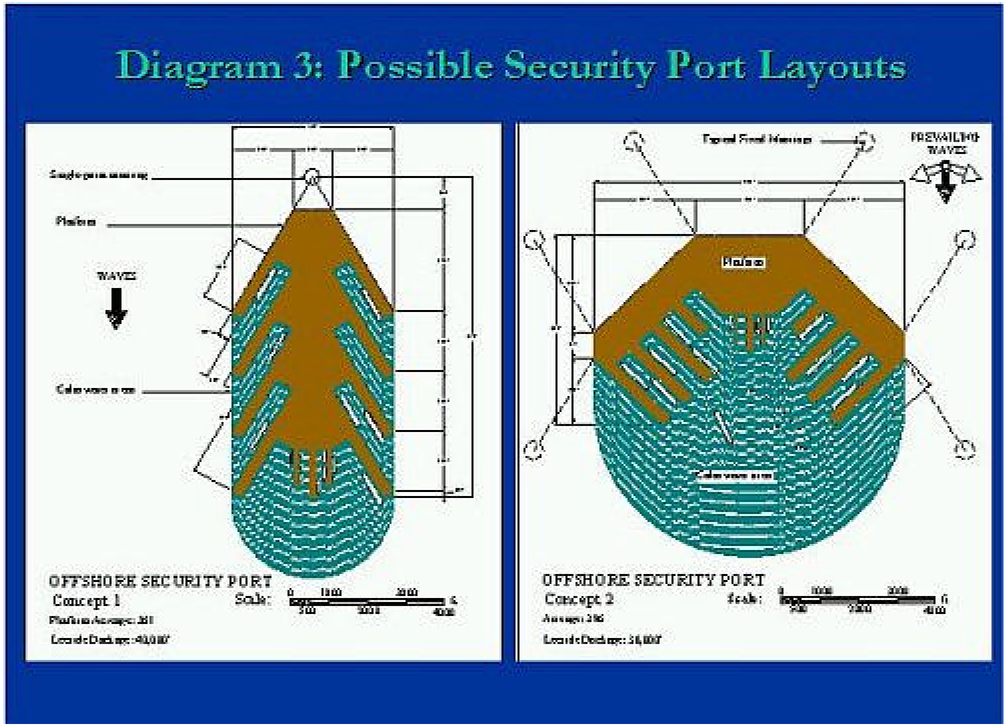


Diagram 3: Possible Security Port Layouts

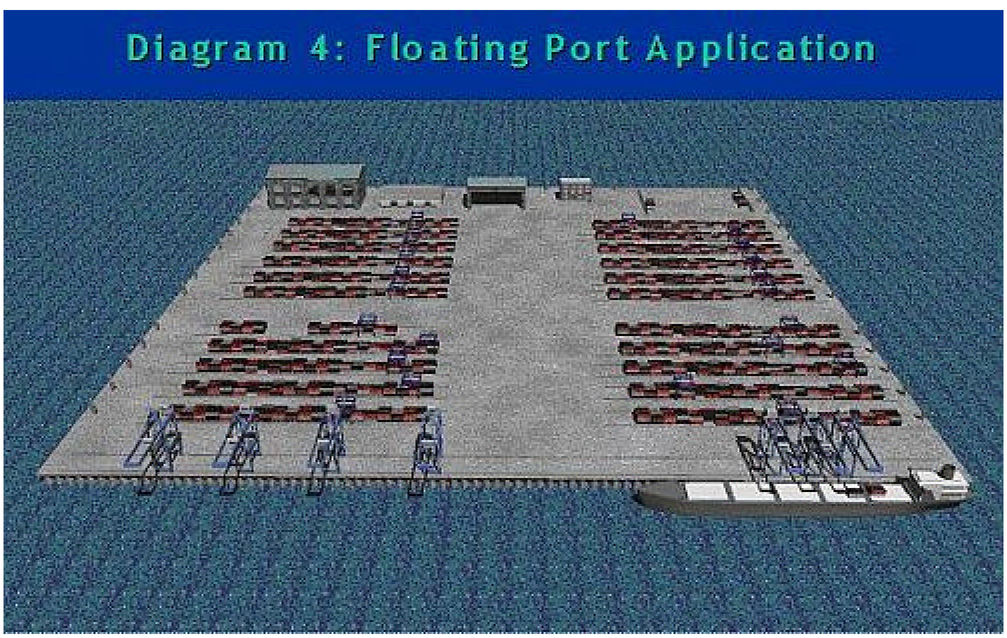


Diagram 4: Floating Port Application

Costs and Efficiencies

Recent offshore platform construction estimates have been competitive with waterfront land values. Each platform's costs are ultimately determined by its intended sea state environment, the proximity of the port to the construction site, and the variable costs of materials and labor. Higher cost platforms include a full array of intermodal operations, such as a tunnel and airfield for truck, rail, and air operations.

For the purposes of this *Strategic Insight* , costs will be estimated for a hypothetical high end platform—on par with a 95-acre, 100-year typhoon-resistant, Asian transfer port that includes platform, anchoring, and top side systems, complete with its own power and water generation systems, plumbing, electrical, HVAC, fire suppression, insurance, front end engineering and development, and operational buildings. The rough order of magnitude in this example is $337 per square foot, or $14.7 million per acre.

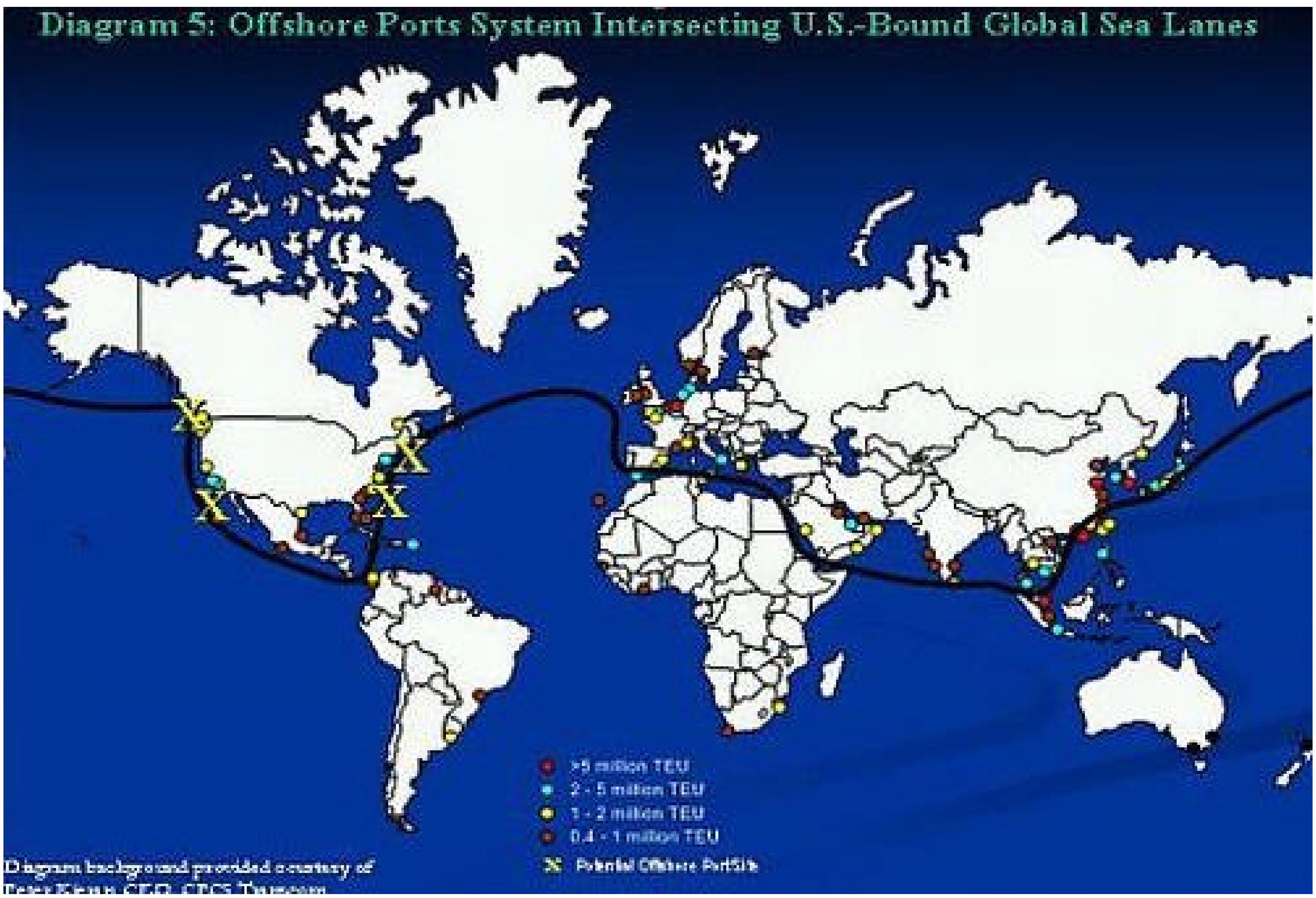
Applying the hypothetical example's assumptions, the costs and capabilities to construct, maintain, and secure an offshore versus traditional ports can be roughly considered. For example, the Port of Vancouver, Washington, with 4,650,000 tons of total cargo volume, is ranked by the American Association of Port Authorities as 51st out of the 100 major U.S. ports.[19] The Port of Vancouver is a 600-acre facility with 15 dockside acres that support 13 deep-draft vessel berths.[20] An offshore port with similar dockside capabilities would cost approximately $2.2 billion if a full complement of intermodal operations were provided at the port (which they are not at the Port of Vancouver):

Comparing 15 Acre Ports	Port of Vancouver	Floating Port
Annual Cargo Volume	4,650,000 tons	4,650,000 tons
2005 Construction Costs	Unknown	$2.2 billion
Estimated Real Estate Costs	High	$0
Territorial Security Risk	High	None
Cargo Inspection Percentage	5%	100%
Maximum Economic Cost of WMD Impact	As high as $1 trillion	Limited to platform personnel, platform construction costs and resources, and docked ships

Longer term cost-savings would be realized by strategically locating the offshore ports along the major sea lanes into the U.S., those entering the New England, Mid-Atlantic/Southeastern, Southern California, and Pacific Northwest regions (see Diagram 5 for one possible layout for an offshore ports system). Grouping the offshore ports as regional megaports would follow consolidation trends already sweeping smaller ports into larger hubs and smaller vessels into mega-container ships. A megaports system would reduce shipping transactions costs significantly, require fewer port calls, reduce nautical mileage at sea, and cut waiting and berthing times in port. Similar costs savings have been realized in the Port of Singapore, the world's Asian transshipment crossroads that transfers regionally-bound cargo to smaller vessels for eventual offload among a large network of local ports. A similar concept has also been proposed as a transshipment port between Halifax and Scapa Flow to feed all Western European and North American ports.[21]

The cost of not adopting offshore ports should also be considered. First, there are the federal government's post-9/11 security standards. When compared to an overhaul of all 351 U.S. ports to be fully compliant across the expanding list of federal security standards—a cost estimate for which has been estimated to be so large that it has not been quantified beyond a crude estimate of "many billions of dollars"—a system of offshore ports is a bargain.[22] Second, there is the issue of the existing ports system's need to serve a changing maritime industry. Megaships that now dominate the industry will be served only by expensively retooling hundreds of existing ports to accommodate this new breed of ships' deeper water berthing requirements. For example, dredging operations to lower the New York Harbor by just 50 feet will require an outlay of $2.1 billion.[23] If offshore ports are adopted, the land-based ports could receive cargo on shallow draft lighters or barges, so the expensive dredging upgrades would be significantly reduced or eliminated altogether. Dredging is also environmentally destructive, so cleanup and other costs could be realized through offshore ports' construction as well.

Cost comparisons become even more favorable when foreign port compliance is considered. Many nations have simply refused request to comply with U.S.-backed security standards due to the impossible economic damage that would be inflicted on their smaller economies to do so.[24] If foreign ports will not raise their standards, then the standards could be enforced at the offshore ports. Offshore ports also provide the opportunity to concentrate the government's Container Security Initiative (CSI) people and resources in centralized locations, versus diluting their effectiveness by dispersing them throughout the world's many ports.



A Defense-in-Depth Strategy

Providing the conceptual underpinnings for a comprehensive cargo and port defense-in-depth strategy, the Department of Homeland Security's "A National Cargo Security Strategy White Paper," envisions enhanced physical security of the global supply chain, recognition of nuclear, chemical, biological, and radiological materials as the highest cargo security threat, and the necessity to identify and inspect 100 percent of high risk cargo.[25] In realizing such a strategy, two essential elements must be considered: information systems and geography. The more information that is available about every ship and container that moves around the globe, the less likely that a dangerous shipment will leave one port or reach another. The further away from U.S. soil, or "pushing out our borders," that such information enables, makes it much less likely that any cargo that might slip through a secure information system will still be able do its intended damage.

Information systems would provide the first line of the defense-in-depth. The information systems security process would start before shipping commences, with an internationally sanctioned purchase order entry into a secure information system prior to cargo ever making its way into a shipping container.[26] Currently, port terminal operators have no reliable way of verifying that a cargo manifest matches the actual contents of a container.[27] Using Federal Express-styled tracking technology, a bar coded container could then be tracked from its inspected source through its destination.

Recognizing that no information system is perfectly secure, an intelligence component of the cargo tracking system would target high risk cargo based on human and artificial intelligence—an algorithm of all of the system's measurable criteria, such as cargo contents, point of origin, number and locations of cargo transfers, wholesalers and distributors, and every other cargo risk factor. Insurance, banking, and financial market algorithm systems have perfected artificial intelligence techniques to the point that the technology gets "smarter" in its predictive abilities with each additional use of the system.[28] The cargo security system would in effect become more secure with every container passed through the system. Coupled with a random inspection selection process that would be triggered in the information system, and the expertise of human intelligence analysts, high risk and randomly selected cargo could then be identified for a thorough search. All other cargo would go through a standard search process at later lines of the defense-in-depth described below.

The cargo inspection site at an offshore port would be the second line of the defense-in-depth. Offshore ports personnel and systems would screen all high risk cargo and up to 75% of all remaining cargo. They would also be responsible for separating containers to transfer them to truck, air, ship, or rail from foreign vessels onto U.S.-provided transportation that would take the cargo to its ultimate destination. Currently, most every port in the United States lacks the onsite capability to disseminate and transfer cargo to sea, air, rail, and truck operations. Using the Port of Vancouver example, air operations commence only after a package is trucked 15 miles away to the airport. In the process of making the U.S. more secure, an offshore port would also enable an economically efficient hub and spoke transfer system into the country.

If the second line's offshore port was physically attacked, the consequences would be dramatically less severe than one at a U.S.-based port. A USS Cole-equivalent attack would not sink a several hundred acre platform due to the interlocking support provided by thousands of individually buoyant and concrete reinforced cylinders. Unlike steel, concrete does not conduct heat, so a conventional weapon's damage would be locally contained. Even if a weapon caused damage enough to ruin an entire section of a large platform, that section could be released, dropped to the ocean floor, and replaced with a newly constructed section. The platform would be repaired in its present location without having to be transported to a port. A more consequential WMD attack might destroy or make uninhabitable the port site, which would still result in the confined destruction of the port facility itself, its docked ships, and its people, cargo, and supplies.

In line with Deputy Secretary of Homeland Security, Admiral James Loy's belief that, "We want our existing ports to be our final line of defense, not the first,"[29] the third line of defense in the defense-in-depth would be the existing U.S. ports system. This line of defense would perform inspection on any cargo left uninspected.

Regulation and Management: A Public/Private Organizational Partnership

A federal oversight and private delivery model would well serve an offshore ports system. Such a public/private partnership would provide for the necessary federal law enforcement, accountability, security, and control of foreign cargo entering the U.S., while also allowing for the private sector to compete and contract for intermodal transfer, offload, and shipping operations. Both government and industry would be able to consolidate currently redundant inspection, onload/offload, transport, and other operations.

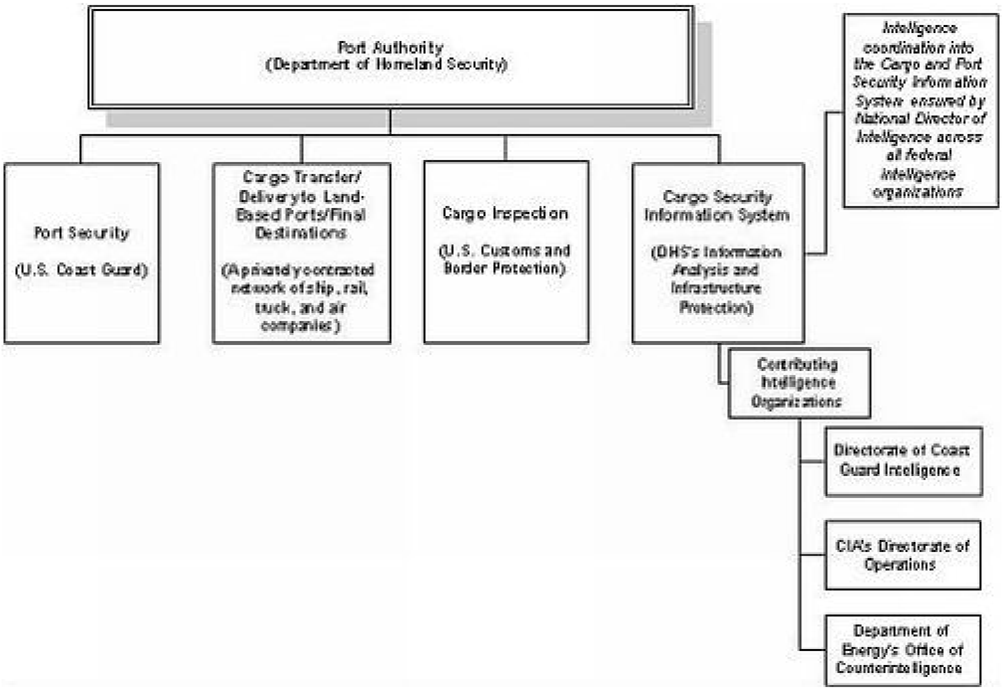
Establishing the offshore ports as federal installations offers several advantages. First, it would guarantee their subsidization and regulation to a common standard. The current ports system is fraught with taxpayer inequities in which local residents assume a disproportionate tax burden for cargo destined to go well beyond their jurisdiction's borders. The system is also plagued by tight local and state budgets that cannot support many of the newly imposed federal security standards.

Second, the federal government is the only entity that could both legally mandate and enforce the stopping of all ships bound for the U.S. and absorb the initial construction costs of an offshore ports system. A comprehensive system that includes ports intersecting sea lanes off of both coasts would total as much as $15 billion, and no single state, agency, company, or industry short of the federal government could absorb such an expenditure.

Third, no entity other than the federal government would be capable of seamlessly conjoining port operations among the existing 351-ports system and integrate critical federal functions such as foreign intelligence, inspection, customs, international law, and law enforcement. An essential federal coordination role—intelligence sharing in the cargo security information system—could be facilitated through the new National Director of Intelligence, an office envisioned for just this type of task by President Bush who wants to ensure "that our intelligence agencies work as a single, unified enterprise."[30]

Private industry's role would be to work within the federal offshore ports system to onload and offload cargo, transfer cargo to sea, air, and rail lines, and transport that cargo to the inland ports and other intermodal lines, and ultimately to its destination.

While there are many different ways to organize around the public/private partnership principle, one possible scenario is charted below.



Conclusion

The current cargo and port security system is incapable of preventing or managing the consequences of a WMD attack; the time to fix the system is now. Offshore ports can contribute to a new cargo and port security system that has the depth and flexibility necessary to thwart how terrorists plan to attack us, respond to them when they implement their plans, and mitigate and recover from any event in which they are successful in implementing their plans. In addition to contributing to a more secure system, offshore ports can also provide a more economical one.

For Further Information

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About the Author

Dr. Michael Hillyard is President of Rockwell University, an institution dedicated to advancing computer sciences and information technologies through training, education, and consulting. He was previously Provost of the American Public University System and Dean of the American Military University. He has authored *Homeland Security and the Need for Change* (Aventine Press, 2002) and *Public Crisis Management: How and Why Organizations Work Together to Solve Society's Most Threatening Problems* (Writers Club Press, 2000). Hillyard served as an active duty and reserve officer in the U.S. Marine Corps from 1992-2004. He is a graduate of Miami University (Ohio) and the University of Southern California, where he received his doctorate in public administration.

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8. Organisation for Economic Co-operation and Development, Maritime Transportation Committee, *Security in Maritime Transport: Risk Factors and Economic Impact*, July 2003, p.16.

9. Offshore Technology Conference, "OTC Distinguished Achievement Awards for Companies, Organizations, and Institutions," May 5, 2003, Houston, Texas.

10. Pearl Harbor Naval Shipyard's acreage is reported as 160 acres in the annual Department of Defense document, *Military Installations by Branch of Service, Acreage, Personnel, and Classification*.

11. Technical source references are provided above the reference section, at the end of the text of this *Strategic Insight* .

12. It is important to note that this system uses air for buoyancy rather than water ballast, which represents a significant difference from the older semi-submersible platforms.

13. Offshore Ports, "How does the PCP Work?."

14. Float Incorporated, "How it works."

15. Offshore Ports, "Has this ever been done before?."

16. This platform has a closed bottom and does not use air movement to reduce platform stress as the standard PSP application does.

17. Dana Canedy, "*Navy Leaves a Battered Island, and Puerto Ricans Cheer,*" *The New York Times*, May 2, 2003.

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